



YANMAR

SERVICE MANUAL

INDUSTRIAL DIESEL ENGINE

MODEL **TNE** series



YANMAR DIESEL ENGINE CO., LTD.

FOREWORD

This Service Manual describes the procedure of maintenance and service of the Yanmar industrial TNE series engine (Special swirl precombustion chamber (hereinafter "Indirect injection system") and Direct injection systems).

Before starting service and maintenance of TNE engine, you are requested to read this Service Manual carefully to your full understanding and to take careful note that the standard TNE engine may differ in the structure and applicable specification from that loaded on each of individual driven machines (such as the generator, pump, compressor, and combine, etc.).

For further information, carefully read the Service Manual issued for each driven machine.

This Service Manual in subject to changes, with or without notice, with respect to the structure and the content of maintenance for the purpose of improving engine quality.

Setup before work

To perform work efficiently, the following setup (preparation) is necessary.

1. Customer ledger check

- (1) Previous date of service
- (2) Check on which month (and at what time) the last service was performed, what problem occurred, and what the history of the customer (engine) is.

2. Stock control of parts

- (1) Stock check for consumable parts, periodic replacement parts, etc., that are required for service.
- (2) Provision of check list, parts list and parts card.

3. Provision of service record

- (1) Work (process) time table
 - (2) Check sheet (including used parts list)
 - (3) Measurement data of parts
 - (4) Operation data and quality
- } (for maintenance of performance and quality)

4. Disassembly and reassembly tools

- (1) Tools
- (2) Measuring devices
- (3) Other instruments and equipment necessary for service



This product has been developed, designed and produced in accordance with the Standards for Quality System of ISO 9001 (International Organization for Standardization) under the following authorized institutions: JMI (Japan Machinery and Metals Inspection Institute), BSI (British Standards Institution) and EQNET (The European Network for Quality System Assessment and Certification).

Certified under the following standards:
 ISO 9001 - 1987 / BS 5750 : Part 1 : 1987 /
 EN 29001 - 1987 / JIS Z9901 - 1991

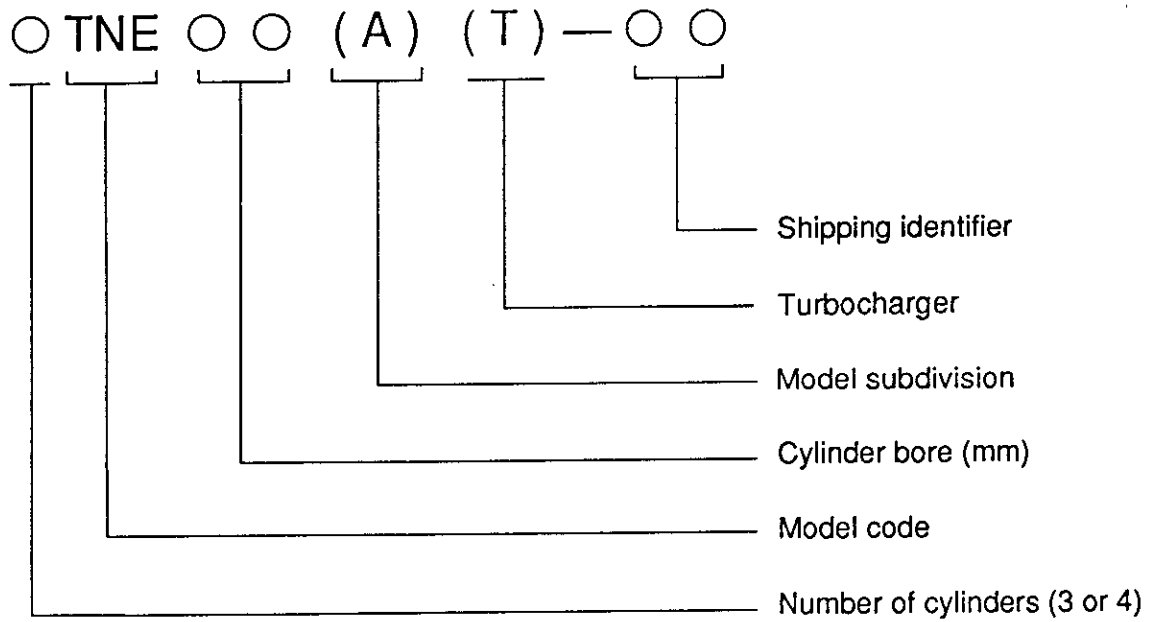
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○ **Descriptive Breakdown of Model Name**



○ **Application Category**

Application code	Usage	Eng. Rev. type	Revolution speed (rpm)
CL	Generator drive	Constant	1500 / 1800
CH			3000 / 3600
VM	General use	Variable	2000 ~ 3000
VH			3000 ~ 3600

* For engine application category described in Chapter 1, Specifications and Performance.

1. Specifications and Performance

1-1 2TNE68

* Output conditions: Intake back pressure ≤ 250 mmAq, Exhaust back pressure ≤ 550 mmAq, other conditions complying with JIS D 1005-1986. After minimum 30 hour's run-in.

Item		Model	2TNE68											
		Unit												
SPECIFICATIONS	Application	—	VM				CH			VH				
	Type	—	Vertical, 4-cycle water-cooled diesel engine											
	Combustion system	—	Special swirl pre-combustion chamber											
	No. of cylinders – Bore × Stroke	mm	2 – 68 × 72											
	Displacement	ℓ	0.523											
	Firing order	—	1 – 2											
	Revolution speed	rpm	2000	2200	2400	2600	2800	3000	3000	3600	3200	3400	3600	
	Output*	Continuous rating	kW(HP)	—	—	—	—	—	—	7.72 (10.5)	9.12 (12.4)	—	—	—
		Max. rating	kW(HP)	5.74 (7.8)	6.25 (8.5)	6.84 (9.3)	7.43 (10.1)	7.94 (10.8)	8.46 (11.5)	8.46 (11.5)	10.0 (13.6)	8.68 (11.8)	9.19 (12.5)	9.64 (13.1)
	Max. revolution speed at no load	rpm	2180^{+50}_0 2375^{+50}_0 2570^{+50}_0 2780^{+50}_0 2970^{+50}_0 3180^{+50}_0 3180^{+50}_0 3780^{+50}_0 3425^{+50}_0 3640^{+50}_0 3850^{+50}_0											
	Min. revolution speed at no load		≤800				≤1500			≤800				
	Direction of rotation	—	Counterclockwise (viewed from flywheel)											
	Power take off	—	Flywheel											
	Compression ratio	—	23.0											
	Fuel injection timing (FID, b.T.D.C.)	deg	14±1						16±1					
	Compression pressure	MPa (kgf/cm ²)	3.24±0.1 (33±1), at 250 rpm											
	Fuel injection pressure	MPa (kgf/cm ²)	11.8 ^{+1.0} ₀ (120 ⁺¹⁰ ₀)											
	Recommended diesel gas oil	—	ISO 8217 DMA, BS 2869 A1 or A2 (Cetane No. 45 min.)											
	Lubrication system	—	Forced lubrication with trochoid pump											
	Lubricating oil capacity Max/Effective	ℓ	1.6/0.6						2.3/1.0					
	Recommended lubricating oil	—	API grade CC class or higher											
	Cooling system	—	Liquid cooling/Radiator											
	Cooling water capacity	ℓ	0.6 (for engine only)											
	Cooling fan No. of blade × dia.	mm	Discharge type, 5 × φ290											
	Crank V-pulley dia./ Fan V-pulley dia.	mm	φ95/φ85											
	Governor	—	Mechanical centrifugal governor (All speed type)											
Starting system	—	Electrical												
*1 Dimensions L × W × H	mm	373.5 × 417 × 498 / 383.5 × 417 × 498						383.5 × 409 × 540			373.5 × 417 × 540 / 383.5 × 417 × 540			
*1 Dry weight	kg	55 / 65						65			55 / 65			
PERFORMANCE	Governing performance (full speed range)	Transient speed difference	%		≤12				≤10			≤12		
		Steady state speed band	%		≤9	≤8	≤7	≤6	≤5			≤7		
		Recovery time	sec		≤6									
		Fluctuation of revolution	rpm		≤30				≤20			≤30		
L.O. press.	Rated operation	MPa (kgf/cm ²)	0.25±0.05 (2.5±0.5)		0.29±0.05 (3.0±0.5)			0.34±0.05 (3.5±0.5)						
	Idling		≥0.06 (≥0.6)											

*1. Designation of engine dimension and dry weight in numerals.
 CL/CH application: engine with flywheel housing
 VM/VH application: engine with back plate/with flywheel housing

1. Specifications and Performance

1-2 3TNE68

* Output conditions: Intake back pressure ≤ 250 mmAq, Exhaust back pressure ≤ 550 mmAq, other conditions complying with JIS D 1005-1986. After minimum 30 hour's run-in.

Item		Model	3TNE68											
		Unit	VM			CH			VH					
Application		—	VM			CH			VH					
Type		—	Vertical, 4-cycle water-cooled diesel engine											
Combustion system		—	Special swirl pre-combustion chamber											
No. of cylinders – Bore × Stroke		mm	3 – 68 × 72											
Displacement		ℓ	0.784											
Firing order		—	1 – 3 – 2 – 1											
Revolution speed		rpm	2000	2200	2400	2600	2800	3000	3000	3600	3200	3400	3600	
Output*	Continuous rating	kW(HP)	—	—	—	—	—	—	11.7 (15.7)	13.7 (18.4)	—	—	—	
	Max. rating	kW(HP)	8.6 (11.5)	9.4 (12.6)	10.3 (13.8)	11.2 (15.0)	12.0 (16.1)	12.9 (17.3)	12.9 (17.3)	15.1 (20.2)	13.1 (17.6)	13.8 (18.5)	14.5 (19.4)	
Max. revolution speed at no load		rpm	2180 ⁺⁵⁰ ₀	2375 ⁺⁵⁰ ₀	2570 ⁺⁵⁰ ₀	2780 ⁺⁵⁰ ₀	2970 ⁺⁵⁰ ₀	3180 ⁺⁵⁰ ₀	3180 ⁺⁵⁰ ₀	3780 ⁺⁵⁰ ₀	3455 ⁺⁵⁰ ₀	3670 ⁺⁵⁰ ₀	3890 ⁺⁵⁰ ₀	
Min. revolution speed at no load			≤800			≤1500			≤800					
Direction of rotation		—	Counterclockwise (viewed from flywheel)											
Power take off		—	Flywheel											
Compression ratio		—	23.0											
Fuel injection timing (FID, b.T.D.C.)		deg	14±1						16±1					
Compression pressure		MPa (kgf/cm ²)	3.24±0.1 (33±1), at 250 rpm											
Fuel injection pressure		MPa (kgf/cm ²)	11.8 ^{+1.0} ₀ (120 ⁺¹⁰ ₀)											
Recommended diesel gas oil		—	ISO 8217 DMA, BS 2869 A1 or A2 (Cetane No. 45 min.)											
Lubrication system		—	Forced lubrication with trochoid pump											
Lubricating oil capacity Max/Effective		ℓ	2.4/1.0						3.0/1.0					
Recommended lubricating oil		—	API grade CC class or higher											
Cooling system		—	Liquid cooling/Radiator											
Cooling water capacity		ℓ	0.9 (for engine only)											
Cooling fan No. of blade × dia.		mm	Pusher type, 5 × φ310											
Crank V-pulley dia./ Fan V-pulley dia.		mm	φ105/φ85											
Governor		—	Mechanical centrifugal governor (All speed type)											
Starting system		—	Electrical											
*1 Dimensions L × W × H		mm	463.5 × 401 × 496 / 473.5 × 401 × 496						473.5 × 401 × 496			463.5 × 401 × 496 / 473.5 × 401 × 496		
*1 Dry weight		kg	70 / 81						81			70 / 81		
PERFORMANCE	Governing performance (full speed range)	Transient speed difference	≤12						≤10			≤12		
		Steady state speed band	≤9	≤8	≤7	≤6	≤5			≤8				
		Recovery time	≤6											
		Fluctuation of revolution	≤30						≤20			≤30		
L.O. press.	Rated operation	MPa (kgf/cm ²)	0.25±0.05 (2.5±0.5)			0.29±0.05 (3.0±0.5)			0.34±0.05 (3.5±0.5)					
	Idling	≥0.06 (≥0.6)												

*1. Designation of engine dimension and dry weight in numerals.
 CL/CH application: engine with flywheel housing
 VM/VH application: engine with back plate/with flywheel housing

1-3 3TNE74

*Output conditions: Intake back pressure ≤ 250 mmAq, Exhaust back pressure ≤ 550 mmAq, other conditions complying with JIS D 1005-1986. After minimum 30 hour's run-in.

Item		Model	3TNE74											
		Unit	VM			CH			VH					
Application		—	VM			CH			VH					
Type		—	Vertical, 4-cycle water-cooled diesel engine											
Combustion system		—	Special swirl pre-combustion chamber											
No. of cylinders – Bore × Stroke		mm	3 – 74 × 78											
Displacement		<i>e</i>	1.006											
Firing order		—	1 – 3 – 2 – 1											
Revolution speed		rpm	2000	2200	2400	2600	2800	3000	3000	3600	3200	3400	3600	
Output*	Continuous rating	kW(HP)	—	—	—	—	—	—	15.1 (20.2)	17.4 (23.3)	—	—	—	
	Max. rating	kW(HP)	11.0 (14.8)	12.1 (16.2)	13.2 (17.7)	14.3 (19.2)	15.5 (20.8)	16.6 (22.3)	16.6 (22.3)	19.1 (25.6)	16.6 (22.3)	17.1 (22.9)	17.7 (23.7)	
Max. revolution speed at no load		rpm	2180 ⁺⁵⁰ ₀	2375 ⁺⁵⁰ ₀	2570 ⁺⁵⁰ ₀	2780 ⁺⁵⁰ ₀	2970 ⁺⁵⁰ ₀	3180 ⁺⁵⁰ ₀	3180 ⁺⁵⁰ ₀	3780 ⁺⁵⁰ ₀	3455 ⁺⁵⁰ ₀	3670 ⁺⁵⁰ ₀	3890 ⁺⁵⁰ ₀	
Min. revolution speed at no load			≤800			≤1500			≤800					
Direction of rotation		—	Counterclockwise (viewed from flywheel)											
Power take off		—	Flywheel											
Compression ratio		—	23.0											
Fuel injection timing (FID, b.T.D.C.)		deg	14±1						16±1					
Compression pressure		MPa (kgf/cm ²)	3.43±0.1 (35±1), at 250 rpm											
Fuel injection pressure		MPa (kgf/cm ²)	11.8 ^{+1.0} ₀ (120 ⁺¹⁰ ₀)											
Recommended diesel gas oil		—	ISO 8217 DMA, BS 2869 A1 or A2 (Cetane No.: 45 min.)											
Lubrication system		—	Forced lubrication with trochoid pump											
Lubricating oil capacity Max/Effective		<i>e</i>	2.4/1.0						3.3/1.4					
Recommended lubricating oil		—	API grade CC class or higher											
Cooling system		—	Liquid cooling/Radiator											
Cooling water capacity		<i>e</i>	0.9 (for engine only)											
Cooling fan No. of blade × dia.		mm	Pusher type, 5 × φ310						Pusher type, 6 × φ335					
Crank V-pulley dia./ Fan V-pulley dia.		mm	φ110/φ85						φ110/φ97					
Governor		—	Mechanical centrifugal governor (All speed type)											
Starting system		—	Electrical											
*1 Dimensions L × W × H		mm	469.1 × 440 × 502 / 476.6 × 440 × 502						476.6 × 440 × 502			469.1 × 440 × 502 / 476.6 × 440 × 502		
*1 Dry weight		kg	85 / 102						100			85 / 100		
PERFORMANCE	Governing performance (full speed range)	Transient speed difference	≤12						≤10			≤12		
		Steady state speed band	≤9	≤8	≤7	≤6			≤5			≤8		
		Recovery time	≤6											
		Fluctuation of revolution	rpm	≤30						≤20			≤30	
L.O. press.	Rated operation	MPa (kgf/cm ²)	0.25±0.05 (2.5±0.5)			0.29±0.05 (3.0±0.5)			0.34±0.05 (3.5±0.5)					
	Idling	≥0.06 (≥0.6)												

*1. Designation of engine dimension and dry weight in numerals.
 CL/CH application: engine with flywheel housing
 VM/VH application: engine with back plate/with flywheel housing

1-4 3TNE78A

*Output conditions: Intake back pressure ≤ 250 mmAq, Exhaust back pressure ≤ 550 mmAq, other conditions complying with JIS D 1005-1986. After minimum 30 hour's run-in.

Item		Model	3TNE78A														
		Unit	CL			VM				CH		VH					
Application		—	CL			VM				CH		VH					
Type		—	Vertical, 4-cycle water-cooled diesel engine														
Combustion system		—	Direct injection system														
No. of cylinders – Bore × Stroke		mm	3 – 78 × 84														
Displacement		ℓ	1.204														
Firing order		—	1 – 3 – 2 – 1														
Revolution speed		rpm	1500	1800	2000	2200	2400	2600	2800	3000	3000	3600	3200	3400	3600		
Output*	Continuous rating	kW(HP)	9.1 (12.2)	10.8 (14.5)	—	—	—	—	—	—	18.0 (24.1)	21.0 (28.2)	—	—	—		
	Max. rating	kW(HP)	9.9 (13.3)	11.9 (16.0)	13.2 (17.7)	14.6 (19.6)	15.9 (21.3)	17.2 (23.1)	18.5 (24.8)	19.9 (26.7)	19.9 (26.7)	23.2 (31.1)	20.5 (27.5)	21.6 (29.0)	23.2 (31.1)		
Max. revolution speed at no load		rpm	1575 ⁺⁵⁰ ₀	1870 ⁺⁵⁰ ₀	2180 ⁺⁵⁰ ₀	2375 ⁺⁵⁰ ₀	2570 ⁺⁵⁰ ₀	2780 ⁺⁵⁰ ₀	2970 ⁺⁵⁰ ₀	3180 ⁺⁵⁰ ₀	3150 ⁺⁵⁰ ₀	3745 ⁺⁵⁰ ₀	3455 ⁺⁵⁰ ₀	3670 ⁺⁵⁰ ₀	3890 ⁺⁵⁰ ₀		
Min. revolution speed at no load			≤1200	≤800				≤1500		≤800							
Direction of rotation		—	Counterclockwise (viewed from flywheel)														
Power take off		—	Flywheel														
Compression ratio		—	18.0														
Fuel injection timing (FID, b.T.D.C.)		deg	10±1		12±1		14±1		16±1		24±1		18±1		20±1		24±1
Compression pressure		MPa (kgf/cm ²)	3.14±0.1 (32±1), at 250 rpm														
Fuel injection pressure		MPa (kgf/cm ²)	19.6 ^{+1.0} ₀ (200 ⁺¹⁰ ₀)														
Recommended diesel gas oil		—	ISO 8217 DMA, BS 2869 A1 or A2 (Cetane No.: 45 min.)														
Lubrication system		—	Forced lubrication with trochoid pump														
Lubricating oil capacity Max/Effective		ℓ	3.6/1.3						5.0/1.7								
Recommended lubricating oil		—	API grade CC class or higher														
Cooling system		—	Liquid cooling/Radiator														
Cooling water capacity		ℓ	1.8 (for engine only)														
Cooling fan No. of blade × dia.		mm	Pusher type, 6 × φ335														
Crank V-pulley dia./ Fan V-pulley dia.		mm	φ120/φ90			φ110/φ110											
Governor		—	Mechanical centrifugal governor (All speed type)														
Starting system		—	Electrical														
*1 Dimensions L × W × H		mm	553×489×565			520.5 × 489 × 565 / 528 × 489 × 565				528 × 489 × 565		520.5 × 489 × 565/ 528 × 489 × 565					
*1 Dry weight		kg	138			112/128				124		112 / 124					
PERFORMANCE	Governing performance (full speed range)	Transient speed difference	%	≤10	≤8	≤12				≤10	≤8	≤12					
		Steady state speed band	%	≤5	≤4	≤9	≤8	≤7	≤6	≤5	≤4	≤8					
		Recovery time	sec	≤5			≤6				≤5		≤6				
		Fluctuation of revolution	rpm	≤15			≤25				≤30						
L.O. press.	Rated operation	MPa (kgf/cm ²)	0.29±0.05 (3.0±0.5)						0.34±0.05 (3.5±0.5)								
	Idling		≥0.06 (≥0.6)														

*1. Designation of engine dimension and dry weight in numerals.

CL/CH application: engine with flywheel housing

VM/VH application: engine with back plate/with flywheel housing